VITOTALK

K-W Electronic Service Inc. and Viessmann, partners in heating technology. Controls newsletter, August 2006, Issue 9

New starts can come from various sources. Take, for example, this issue of Vitotalk. The last issue was sent out in February 2005, over a year and a half ago! For that very reason, this issue is dedicated to new starts: new issue, new heating season, new articles, new information, and new controls.

Before we continue forward, lets take a quick moment to look back to the spring. Viessmann had their anniversary open house to celebrate their 25 years in Canada and 20 years in the United States. This was no easy milestone considering the competitive boiler market, the breadth of the product line at the time and the customers' exposure to the name Viessmann.

It was good to see all those invited to Waterloo for the festivities.

So, without further delay, let's begin!

What's new? Vitotronic NR2 controls, Systronik flue gas analyzers, Vitotronic 050 HK1Ms, Vitotronic 100 KK10LONs and Vitosolic solar control, just to name a few.

What's not new is our desire to provide as much detailed information that we can possibly jam into a collection of 8.5x11 pieces of paper. So, please continue reading and if you have any comments, questions or demands, do not hesitate to let us know here at KWE.

Thank you!
KWE editorial staff

Viva! VITOTRONIC

A number of years ago, you might recall that Viessmann introduced a program called Vitotec. This period ushered in a whole era of boilers, controls and other fine hydronic heating products.

Fast forward a few years after the introduction of Vitotec, to present day. The new Vitotronic "NR2" line of controls are making themselves known, project by project. The older Dekamatik controls are all but gone and the time is now to start learning about Vitotronic NR2!

Once again, to make reference to the theme of this Vitotalk, we must make a new start with the commercial Vitotronic controls. But the discomfort of starting new is minimized by everybody's familiarity with residential Vitotronic 200 and 300 boiler controls.

Let's start with an overview of what we had and what we have now.

There were four models of boiler controls and three models of mixing valve controls. They all shared the same menu driven user interface identical to the now current Vitodens 200, WB2 boiler.

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Control	Primary Features
Dekamatik E	Outdoor reset DHW operation Operates two mixing valves Communication via 141 2-wire BUS to mixing valve controls Diagnostics with relay test and sensor checks
Dekamatik M1/M2	Outdoor reset DHW operation Communication to system mixing valve controls Diagnostics with relay test and sensor checks Up to three boiler communication with Dekamatik M2's
KR Boiler Control	Non-outdoor reset DHW operation BMS applications for burner enabling and BMS modulation Diagnostics with relay test and sensor fault output Two stage burner control
HK Mixing Control	Outdoor reset HK1 single mixing valve control HK2 (in control panels) two mixing valve control HK4 (in control panels) four mixing valve control Communication to boiler and other HK controls

Table 1: Overview of Dekamatik boiler controls and mixing valve controls

In This Issue: New Start!•Vitotronic NR2•Hey, are you listening!?•Combustion Theory

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VITOTRONIC Viva!

The changeover of commercial controls from the Dekamatik to Vitotronic has taken place over the past year. This transition has been made easier because the commercial controls are similar to that of the residential models with respect to operation and functionality.

Introduction

The first control that we are going to discuss serves double-duty as a stand-alone control or as part of a multi-boiler system. It's name is Vitotronic 100, GC1. It can be used as a stand-alone control for use in basic DHW-only applications, simple BMS control or multiple control applications due to its communication with a master control, the Vitocontrol-S/C.

The second new boiler control is the Vitotronic 300, GW2. It replaces the Dekamatik E. They both share a great deal of the same functionality. They are both outdoor-reset based controls, as well as providing control for two mixing valves and DHW operation. Like the Dekamatik E, the Vitotronic 300, GW2 can communicate to successive Vitotronic HK mixing valve controls via the LON communication connection.

The third new control is designed to integrate up to four Vitotronic 100, GC1 boiler controls. It provides the outdoor reset functionality and boiler staging/rotation that is required with multiple boiler systems. As well, it can control up to two supply mixing valves and is responsible for DHW production in multiple boiler systems. This control is available in ***Standard*** and ***Custom*** applications. The S version is a wall-mounted control and the C version is incorporated into custom control panels.

The name of the standard control is Vitocontrol-S, VD2/CT3. This unit is used with Vitocrossal boilers (CT3) as well as Vitorond boilers (VD2). There is also a version of this control called the Vitocontrol-S, RS/VB2. This control is designed to work with boilers that use the KK10 style of control.

Above: *The pictures above show how the control panel mounted Vitotronic 333 is flush with the front of the door. The backside of the door shows how the Vitotronic 333 front end is mounted through the door.*

Dekamatik-E	→	Vitotronic 300, GW2
Dekamatik-M1/M2	→	Vitocontrol-S, CT3/VD2 + Vitotronic 100, GC1
KR	→	Vitotronic 100, GC1
Dekamatik HK2 and HK4	→	Vitotronic 050, HK3S Mounted in Vitocontrol-C panel as part of complete system package
Dekamatik HK1	→	Vitotronic 050, HK1M

Table 2: Cross reference between Dekamatik boiler controls and Vitotronic NR2 controls

Vitocontrol-S/C

To open our discussion of the new Vitotronic controls, let's start with the master control, known as the Vitocontrol-S/C. It can communicate with up to four Vitotronic 100, GC1 boilers. This is *obviously* one more than the Dekamatiks could. As well, the master control also has the ability to control two mixing valves and operate DHW production.

The master control comes fundamentally in two configurations: ***Standard*** and ***Custom***. The standard unit provides all the functionality of the control without the options of a custom control panel. The custom unit is part of a custom control package.

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VITOTRONIC Viva!

In terms of Viessmann nomenclature, the master controls are known as a Vitotronic 333, MW1 and a Vitotronic 333, MW1S. Once KWE has worked their magic to prepare the controls for the North American market, the name of the product changes. This is where the ***Standard*** and ***Custom*** designations come into play.

The standard unit looks quite similar to the control that is mounted on the side of the VD2 or CT3 boilers. The primary difference is that while the boiler control has a harness that runs from the control down to the burner, the Vitocontrol-S does not.

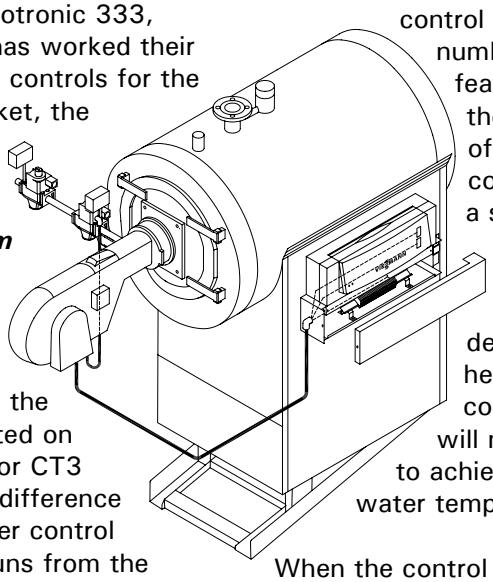
The name, Vitocontrol-S, is only one part of the naming structure for the control. The second part is in reference to the boiler with which it is communicating with. As an example, the most common units are for Vitocrossal and Vitorond boilers. This would mean that a standard unit for multiple boilers is Vitocontrol-S, CT3 or Vitocontrol-S, VD2.

As was mentioned earlier, there is also a Vitocontrol-S, RS/VB2. This control is configured to communicate to Vitotronic 100, KK10LON boiler controls. Having a Vitocontrol-S, RS/VB2 specifically for smaller boilers, means that medium to large residential applications as well as light commercial projects are no longer an issue from a control point of view.

The Vitocontrol-C is the second product capable of having a Vitotronic 333 as part of its overall control strategy. The appearance of the Vitotronic 333 that is used in conjunction with control panels, is such that the user interface is part of the panel door. All of the main control parts, such as the power supply, logic board and output module, are located on DIN rails inside of the panel. The pictures on the preceding page shows these pieces.

Vitotronic 100, GC1

The Vitotronic 100, GC1 is a boiler control that provides a number of various features depending on the overall application of the control. The control can operate as a stand alone unit, operating strictly on set-point. This can be a set-point as determined for space heating or DHW control. The control will modulate the burner to achieve the desired boiler water temperature.



When the control is used in conjunction with a Vitocontrol-S, VD2/CT3, the DHW function is not part of the GC1's operation. As well, if there are specific BMS requirements, refer to the manual to know where to connect the demands/disables.

The Vitotronic 100, GC1 has the ability to operate 30% and 100% boiler protection packages for Vitorond applications.

External control of the Vitotronic 100, GC1 control can be accomplished a number of ways: local connection points on terminal strip inside of junction box, a 0-10VDC input module or a LON card installed into the control. Discussions regarding alternate configurations of the Vitotronic 100, GC1 will be expanded upon at a later date.

Vitotronic 300, GW2

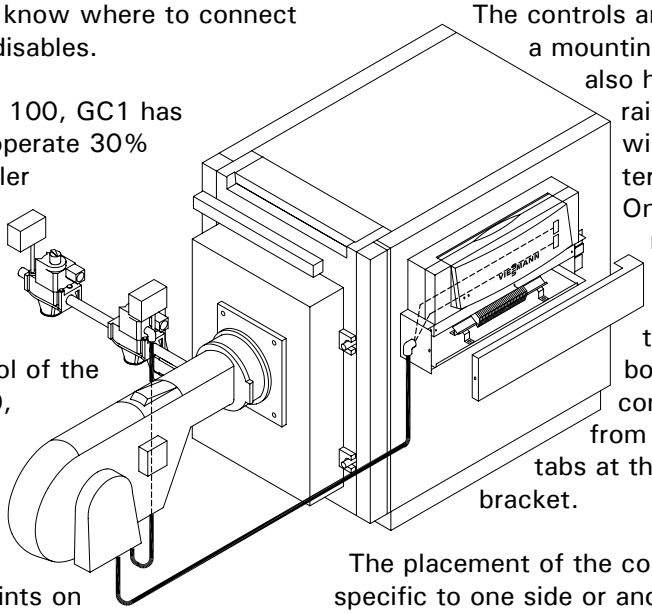
This boiler control can best be summed up as the evolution of the Dekamatik-E. While combining all the primary features of the E, it also includes the ability to incorporate the accessories that are used by the residential Vitotronic 300, KW2

Boiler Control Installation

Both of the Vitotronic 100 and 300 boiler controls, are installed on the side of the boiler. In other words, the boiler controls are NOT installed on the front or top of the boilers.

Installation of the boiler controls on the side of the boiler provides the necessary termination housing to allow an electrician to terminate their wires. This includes control power, burner power as well as all of the outputs of the control.

In larger boiler applications, having the boiler control on the side, keeps the user from having to straddle the burner. This is particularly useful during start-up when the burner tech and the controls tech are trying to occupy the same space (those burner guys are always in the way!)



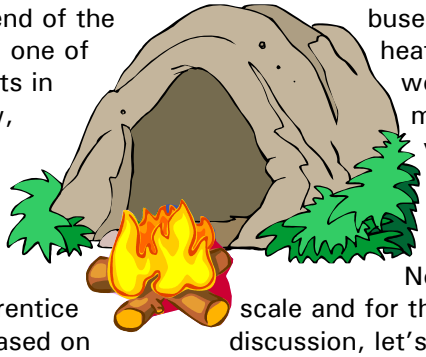
The controls are mounted on a mounting bracket that also houses a DIN rail with all the wiring terminations. Once the mounting bracket is installed on the side of the boiler, the control is hung from a couple of tabs at the top of the bracket.

The placement of the control is not specific to one side or another of the boiler. The design of the junction box allows the placement of the control to be determined at the time of installation. All that is required is rotating the burner harness/junction box before fastening it to the backplate.

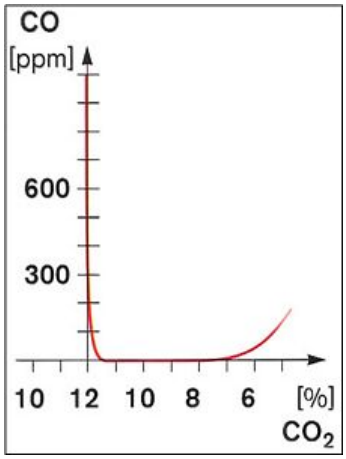
The next issue of Vitotalk, will cover wiring of the individual controls as well as the interconnections with Vitocontrol-S/C. **V**

COMBUSTION

In keeping with the theme of new starts for this issue of Vitotalk, let's go *way* back to the year when fire was first discovered. By the end of the first year, everybody had one of these new fangled fire pits in front of their caves. Now, imagine the cavekeeper grunting with the fire pit technician, Grog. Now, Grog grunts to his apprentice, "Fire burn rich". Of course, his apprentice says, "Fire burn lean". Based on his year of experience, Grog is able to know when a flame is burning rich or lean.



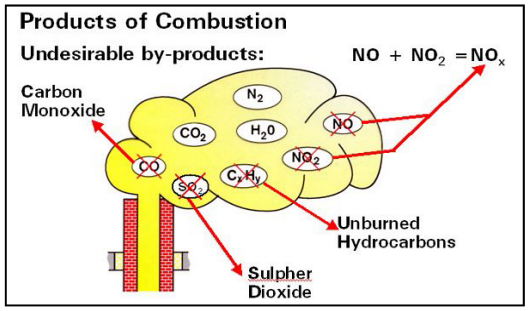
The reason why they were called to have a look at the pit was there was a complaint that the fire was not as hot as it was a few weeks previous. Grog pulls out his trusty fire poker from his mammoth skin tool pouch to inspect the fire further. Little did Grog and his apprentice know, but the cavekeeper neglected to inform Grog they were feeding the fire with wet wood. The extra moisture was causing all sorts of smoke and resulting in complaints from the neighbouring caves. There was only one fix for this, build a new fire with good, dry wood. Grog and his apprentice collected their pelt payment and carried onto their next call.



Fast forward to modern day and consider all the tried and true methods of setting up a burner, shaker bottles, flue gas analyzers or even a smoke test. Now, how many service technicians have you met that can set up a burner with their trusty eye. "*Oh, yeah. Nice and blue, that is just perfect,*" or "*Nice and orange, that's the way to go!*" Ring a bell?

Combustion is a science unto itself, but we do not give it a second thought throughout our daily lives. For a moment, think about everything that combustion does: moves our cars, buses, planes, provides heat and electricity as well as making the raw materials that go into virtually *EVERYTHING* that we use, touch, eat or drink.

Now, on a smaller scale and for the purposes of this discussion, let's just look at the aspect that people depend on everyday: heating their homes. Generally, a second thought about heating is never given unless they have no heat. That's when *it* hit's the fan. Nevermind the fact they were just talking to their buddies and bragging that their heating appliance is so good, they don't need to have it serviced. Yeah, right.



In the real world, it is very important to have the equipment that is such an integral part in our lives looked at and maintained. Yes, there are those that say, "**I** bought the **best**!" You may think that means it doesn't have to be serviced, but, alas, IT DOES!

So, back to the good ole' days of yore when using a fire poker and an eye were the tools of choice. Don't you think that Grog, and maybe to a lesser extent his apprentice, would have liked to know if they were making CO. Maybe they would like to know if their NOx levels were right or if the fire could have been tweaked a little to get a little more heat or efficiency? Bet that they would!

Back in those days, all they knew was fire was hot, it burned and it worked to scare away the occasional Sabre-toothed tiger or aggressive neighbour.

Today we know lots of things about fire and its uses. We know that a properly designed combustion chamber can give you more fun than you know what to do with, propelling you from 0-60MPH in 4.5 seconds. We also know that CO in high PPM counts can kill in 1 to 3 minutes. Hmmm, sobering thought. So, aside from avoiding speeding tickets by lifting up on the accelerator pedal, how do we prevent excessive CO during combustion?

One of the first ways to prevent CO is to have a healthy respect for how badly things can go wrong when a burner or combustion device is not set up properly. The first hurdle to get past this is to be able to measure CO.

Looking at the CO_2 graph on this page, do you really think that by eyeballing a flame you can distinguish between a CO_2 reading of 11 or 12%? This is where a flue gas analyzer is the only way to know for sure how the combustion is functioning.

Adjustment of combustion comes down to two basic ingredients: Air and Fuel. When the ingredients are together in the correct amount, its all good. But when the amounts are off, hello heartburn!

There are times when adjusting the amount of air is not possible. As an example: an atmospheric boiler does not allow for an air adjustment. Do you know why? Because it's atmospheric?...phew, that was easy.

An atmospheric burner only uses the air that is available to it.

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ANALYZE THESE!

For the past couple of years, K-W Electronic Service Inc., has developed a close relationship with a manufacturer of flue gas analyzers from Germany. The name of this company is Systronik.

We currently carry four models that Systronik makes. The names of these units are Prolyzer, Eurolyzer, Multilyzer and Maxilyzer.

The four units provide excellent coverage over most budgets and overall usage. All the analyzers are well built and share a number of the same parts across the board. This allows for a certain amount of flexibility for those companies that utilize the various Systronik models.

The Prolyzer, Eurolyzer and Multilyzer all have holsters which protect the unit and allow them to attach on the side of the boiler via magnets. This placement allows for easy access during burner calibration.

The Maxilyzer unit is housed in a rugged waterproof case that is ideal for lab environments or work in the field.

Printing out the recorded measurements for your customer is also very convenient. The Maxilyzer is the only unit out of the family of four that provides and on-board impact printer. The remaining units all use an HP infrared thermal printer.

Those of you that have researched the various manufacturers of flue gas analyzers will know that Systronik analyzers provide a very convenient and accessible spot for the condensate trap and filter assembly. The Systronik product uses a condensate trap that is very easily monitored for condensate levels. All of the units, except for the Maxilyzer, have the condensate and filter trap as part of the sampling hose. The Maxilyzer condensate and filter traps are located on the upper cover of the analyzer case.

While this may seem like a minor point, the ability to quickly see how much condensate is being accumulated, as well as knowing when it is to be drained, can provide very useful. This ensures that you are not forced to empty the trap at an important time during the calibration of the burner.

A “Coalescence” filter provides excellent filtration by scrubbing the flue gas sample and virtually eliminating any condensate. This provides for a much more accurate reading of the flue gas properties by the analyzer sensors.

SYSTRONIK®

The battery or power supply part of the analyzer is something that everybody should look at and consider before purchase. The two sister units Prolyzer, and Eurolyzer, use AA batteries for their operation. In a pinch, it is also possible to use a 9VDC battery to power the unit in case they should go dead. There is also a power adapter to allow you to operate the units if the batteries were not replaced in time.

The Multilyzer and Maxilyzer units use internal nickel metal hydride battery packs. This allows the units a long operation times as well as the capability to power/recharge the unit during operation. An internal smart-charge system prevents the batteries from being overcharged.

Some manufacturers of flue gas analyzers use lead acid batteries in their units. Generally, these types of batteries do not like deep cycle operation as well as being putting away discharged. The can also be very expensive to replace when necessary.

Another feature of the Eurolyzer, Multilyzer and Maxilyzer is that the CO sensor is H2 compensated. What this means is that during the combustion process, Hydrogen (H2) may be present in the products of combustion. The presence of H2 in the combustion gases can provide an erroneous high CO analyzer reading.

In keeping with CO, the Maxilyzer and Multilyzer have built-in CO bypass pumps. In case the unit is exposed to a higher than allowed CO reading, the pump will automatically come on and purge the unit of the excessive CO. This pump can also be turned on via the key pad by the user should the unit need to be purged before the limit is reached.

The CO protection mode of the Prolyzer and Eurolyzer units cause the main pump to shut down at limit. A natural purging of the unit will have to occur before the unit is able to measure properly.

The Eurolyzer, Multilyzer and Maxilyzer units are approved by TÜV SÜD By RgG 190, By RgG 219 and By RgG 220 respectively, as well as DIN EN 50379 and CE approval bodies. Check to see if the other units that you are looking at meet the same criteria to achieve these approvals.

As part of the complete analyzer kit, a basic carrying case is supplied to house all of the analyzer accessories. If you require a more robust case, there are other options available such as metal or even a “Pelican” poly-style case. Knowing what can happen on a flight from one side of the continent to the other provides us with the hands-on knowledge of care that these kinds of devices can receive...or not.

Type tested Production monitored
Baumuster geprüft Produktion überwacht
TÜV SÜD
EN 50379

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Prolyzer

- Light and Portable
- CO and O2 gas measurement
- Powered by AA batteries
- AC power supply
- 0-2000PPM CO
- External IR printer option
- Draft measurement
- Calculation of Co2, Excess air, North American Combustion Efficiency and Flue Gas Losses

Eurolyzer

- Light and Portable
- CO and O2 gas measurement
- Powered by AA batteries
- AC power supply
- 0-4000PPM CO
- H2 Compensation
- External IR printer option
- Draft measurement
- Ambient CO measurement program Calculation of Co2, Excess air, North American Combustion Efficiency and Flue Gas Losses

Multilyzer

- Light and Portable
- CO and O2 and NO gas measurement
- Optional 4th sensor
- NiMH battery pack
- AC power supply
- 0-4000PPM CO
- External IR printer option
- Draft measurement
- RS232 Interface
- Calculation of Co2, Excess air, North American Combustion Efficiency, Flue Gas Losses and NOx

Maxilyzer

- Rugged enclosure for harsh environments
- CO and O2 and NO gas measurement
- Optional 4th sensor
- NiMH battery pack and AC power supply
- 0-4000PPM CO
- Integrated impact printer
- Draft measurement
- RS232 Interface
- Calculation of Co2, Excess air, North American Combustion Efficiency, Flue Gas Losses and NOx

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Analyzers purchased through KWE or our partners are all serviced at our facilities in Waterloo, Ontario, Canada. Turn around time for cleaning and calibrations is generally within a week of receiving the unit.

As far as inventory of product, all efforts are taken to ensure that analyzers are available at a moments notice. If, however, something special is required, it generally takes a couple of weeks from the manufacturer.

Those of you who are considering an analyzer, consider trying a Systronik on for size. We have a number of units that are able to travel by themselves to exotic locations, from Nantucket to Nanaimo.

In the next issue of Vitotalk, we will go through the bits and pieces that make a Systronik analyzer what it is. As well, a review of what is required to take measurements with the analyzers.

Oh, by the way, Systronik also makes a great pressure meter. For those of you who are continuously running through pressure meters, take moment to talk to us. For more information regarding analyzers and combustion check out the K-W Electronic Service Inc., web site at www.kwelectronicservice.com or go directly to: www.kwelectronicservice.com/kweweb/CombTheory.htm or have a look at: www.kwelectronicservice.com/kweweb/Analyzers.htm
Look in the next issue of Vitotalk for the new Multilyzer-NG and a detailed review of features. **V**

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COMBUSTION

There is this funny thing that happens when you go up into higher elevation areas; there is less mass weight of air. At this point, you have to de-rate the appliance based on established code guidelines and practices.

A power burner, by its very nature of mechanically moving the air, allows the start-up technician to compensate for elevation changes. Along with air adjustments, incoming gas supply is also adjustable. The combination of both air and fuel provide the start-up technician with all the necessary flexibility to ensure proper combustion. Adjustments made during start-up with the fuel and air are immediately viewable with the combustion analyzer. It is important for the start-up technician to realize that the fuel/air mix is a fine balance. If the analyzer shows that the combustion is a little rich/lean, this maybe due to not enough air/fuel or too much air/fuel. These adjustments are never black and white, but rather various shades of grey.

Start-up technicians with experience on their side, know that there are lots of tricks when dialing in a burner. There are generally gross adjustments which are initially made and any tweaking is accomplished with fine tuning adjustments.

In future issues of Vitotalk, the topic of combustion will be further explored. More detailed information will be reviewed to provide a better understanding of combustion.

A closer look at what happens when the sample enters the wand of a flue gas analyzer will be discussed.

If you have any comments or questions regarding this topic, please let us know.

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Soap Box

Having the tools necessary to perform any task is paramount to being professional and responsible. Various different trades spend lots of money on their tools and this trade is no different. In the case of flue gas analyzers, you can spend a little money or a lot of money for one unit. Whatever manufacturer or how much you have paid for it, the unit has to be made to work for itself. Think of it as another employee, but one that isn't going to embarrass you and make a fool out of themselves at the Christmas/Hanukkah/Kwanzaa work party. Develop a per-use charge and factor it into your regular services.

Once the analyzer is purchased, it must be understood that it has to be maintained on a day-in and day-out basis on top of being cleaned and calibrated. Daily maintenance ensures that condensate does not access the unit. The hoses should be drained completely and any dirty filters discarded in favour of new ones. For service technicians that work out of their trucks, do not keep the analyzers in the trucks if there is the possibility of freezing temperatures. Any of the condensate that could possibly remain would freeze and cause potential damage.

Cleaning and calibration of the analyzer is performed by the people that it was purchased from. Like any tool that provides you with readings or information, it needs to be calibrated. Did you know that there are companies that calibrate your voltmeters or multi-meters?

Make sure the time is taken to ensure your test equipment is up to the task for day-in and day-out usage. Remember that you generally never regret spending more money on something you may use everyday.

Looking Back

Until now, there have been 8 issues of Vitotalk. Many topics covered, but lets look back to see what have been discussed so far.

Vitotalk 1: January 2002
Switching Module V
A Little Electrical Theory
Vitotronic Room Influence Addressing

Vitotalk 2: May 2002
Leading Word on Lag Modules
Slippery Slope to WWSD Point
Electrical Theory: 41 Plug

Vitotalk 3: June 2002
Now! That's a Switch—Switches and Relays
Vitodens (first article) External demand
Multimeter Basics

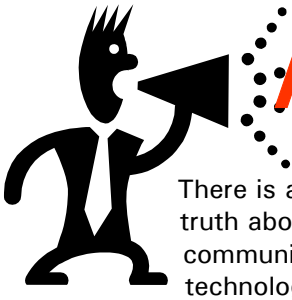
Vitotalk 4: February 2003
Most Referenced Issue!!!
In The Mix: Vitodens & Mix 'N' Valves
Addition of communication board
Wiring of 141 Communications
Whole lot more!!!

Vitotalk 5: August 2003
Tips 'N' Tricks
Phundamentally Fhysics—Transformers
Heating curves Viessmann vs Cascade
LOTS of Cascade Control Information

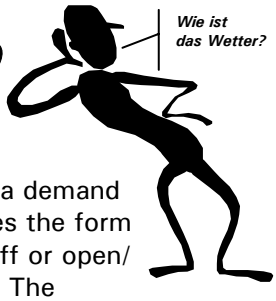
Vitotalk 6: May 2004
Summer is in the Air!
Phundamentally Fhysics—GFCI's
Learning LON—first LON discussion
Diagnostic Do's and Don'ts
Cascade Control—Part Deux

Vitotalk 7: November 2004
All Dried Up—Making of a Dry Contact
Cascade Control—Part Deux Revisited
Vitocontrol-S—Not So Extreme Makeover

Vitotalk 8: February 2005
Communications Issue—GREAT information...to much reading 19 pages!. Do yourself a favour and re-read!!! Great pictures!



Hey! Are You Listening!?



There is a fundamental truth about communication technologies, whether it be now or a hundred years ago: No matter the medium, the message has the possibility of being misunderstood. At no time in history has this been so apparent than right now, during the communication and information age.

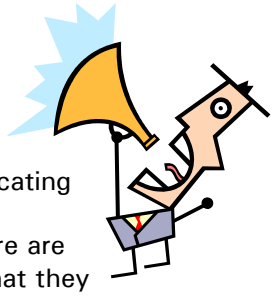
How many times have you pulled up to your local coffee shop drive-thru window to be greeted by a voice over the crackly speaker, "Hello, how m% $ %^&* I :) h(:) (*^&^#% me &^%^&**. This is a fine example of how one of the most simplistic communication moments, and yet the outcome can ruin your whole day.

The objective of a communications exchange has to be determined, or at the very least expected, *before* the information or communication starts. It must be clear and concise. The exchange has to be understood by both parties to ensure a correct and desired outcome.

Again for a moment, return to the same drive-thru at your favorite coffee shop. Seems like you have been waiting for hours, doesn't it? Instead of a coffee and a muffin, order a burger and fries. In a split second you have altered the anticipated communication exchange between you and that under-paid voice at the other end. At this point, the answer you will receive is anybody's guess. It is this aspect that is the very same with respect to interconnecting control devices.

There is an ever increasing demand for electronic devices to communicate with one another. Time and time again, you hear the complaint, "Yeah, I bought this orange boiler and this blue control and now I can't get them to communicate." Now, hold on for a moment, did you honestly believe it was that easy? Put tab A in slot B and *viola*, communications.

It has only been during last decade or so that the possibility of universal communications between different manufacturers has even been addressed. Years of proprietary control protocols from the three main industry leaders is changing. The writing was on the wall for this kind of strategy. As more and more device manufacturers started accepting an open communication protocol platform, the industry was forced to change. Hopefully, this will provide a level playing field for small to large control providers.



What *is* and *isn't* communication? Is there really a difference between communicating and demanding/commanding? There are those who think that they are the same...well they're not.

Communication is the exchange of data and information from a sender to a receiver. There is a data exchange that takes place between those devices that are interconnected with one another. Quite often, reference is made to a communications protocol that basically refers to the language that is used between the sender and the receiver. As an example, if you were trying provide a tourist with directions, to...let's say a coffee shop, but they didn't understand English, the likelihood of complete understanding would be very slim. There are also those times when even speaking English, words or phrases may be used, but not universally understood.

How does demanding or commanding differ? Generally a demand or command takes the form of a yes/no, on/off or open/closed operation. The output of a control or device is a function of the input. If a specific input is demanded, a specific output occurs.

The fundamentals have to be understood and applied correctly when talking about interconnections between controls. Here are some examples of both communication and demanding/commanding and certain aspects of each method.

Communication or Communicating:
1. Specific protocol
2. Specific media
3. Control gateway
4. Large amounts of data exchanged between controls

Demanding or Commanding:
1. Burner external enable
2. Burner external disable
3. Burner high fire demand
4. Burner call for heat
5. Demand for DHW

Here are a couple of applied examples. Check the correct boxes and look to the back page for the correct answer:

TT connection to KK10/K10:
☐Communication
☐Demand/Command

BMS connections to 143/146 plugs:
☐Communication
☐Demand/Command

Dekamatik-M1 to Dekamatik M2/HK:
☐Communication
☐Demand/Command

Vitocontrol-S, WB2 to Vitodens boilers
☐Communication
☐Demand/Command

Interconnections from Vitocontrol-S/C:
☐Communication
☐Demand/Command

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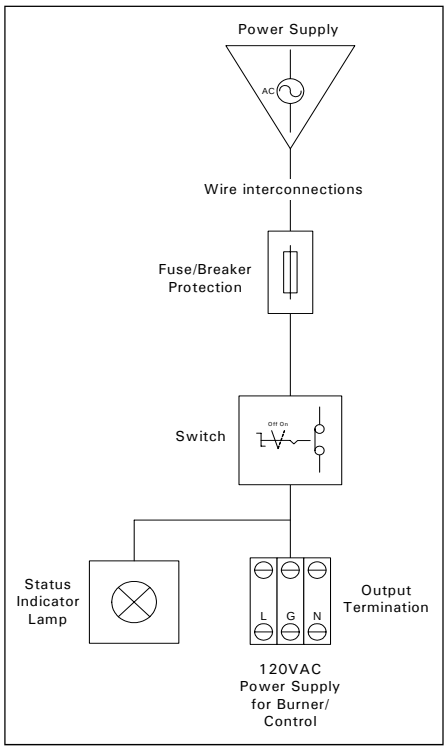
vvvv

Control Corner

Custom

The application of a custom control panel to any job is like the icing on a cake. When done well, the custom control is an invaluable addition to any new boiler room or retrofit installation. However, it seems to be the most misunderstood part of the system. There can be lots of answers for this, but hopefully, this series of articles will address the unknowns to take care of any unanswered questions.

Where to start? First of all, a custom control panel is called a Vitocontrol-C. The C is a designation for ***Custom*** and the word Vitocontrol is representative for the family of controls. As most of you already know, there are Vitocontrol-S controls that are "off-the-shelf" controls which provide basic control functions for the system. This is where a *C* differentiates itself from an *S*.



Drawing 1: Power Supply 120VAC Output

Quite often, the most frequently asked question of a Vitocontrol-C is, "What can it do?" The response that gets heads spinning is, "Whatever you want it to do". The features of the panels really has more to do with imagination than anything else.

There are a number of baseline features which provide great convenience and service-friendly capability that should not be overlooked.

Power Supplies

A good starting point for Vitocontrol-C functionality is to first address power supplies—both incoming and outgoing. Depending on the system, you may or may not have to include this functionality into the panel. However, having a control panel provide local control/distribution of boiler control/burner voltage, primarily eliminates hunting down the elusive job site electrician during times of start-up and servicing. It should also be noted that as part of the components that make up the power supply portion of the panel, the necessary breakers/ fuses are included in the panel. The only aspect that is generally required by the electrician is a feed from the main disconnect panel.

As part of the control panel features, you may also incorporate visual identification of incoming voltage. In some instances, you may even want an alarm for notification if there should be a voltage drop-out or a blown fuse for one of the phases during regular operation.

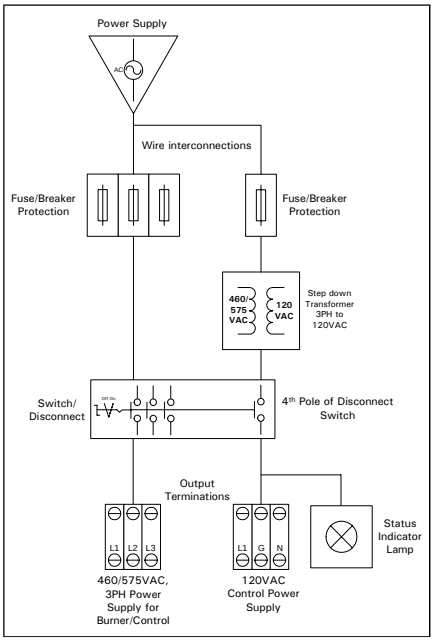
A great deal of the options available on Vitocontrol-C's are the result of past users' and owners' experience with either Multimatik or Vitocontrol panels.

The drawings shown on this page provide a pictorial overview of the bits and pieces that go into a power supply 'module' in a custom control panel. Drawing 1, provides an overview of a 120VAC Power supply module. In a typical application of this control panel module would supply 120VAC to a boiler control or some other device that requires 120VAC for its operation. Note the On/Off switch, status indicator lamp and the output terminals.

As we move from the basic 120VAC output of Drawing 1, to the more complex power supply for 460/575VAC applications, we see an increased number of components within the power supply module. Note the circuit protection with the fuse/ breakers. A disconnect switch controls On and Off, via its three pole configuration. A 4th pole for switching of a 120VAC control circuit is also incorporated.

The inability to *create* a 120VAC circuit from 460/575VAC power supplies means that we have to add a control transformer. This transformer takes the incoming 460/575VAC and provides a 120VAC output.

As you can see by looking at these two power supply options, they are somewhat different in their individual details the functionality is the same. The incoming voltage supply is run through a circuit protection device, a switching device and is then outputted to the connected load.



Drawing 2: Power Supply 460/575VAC

In a typical application, when sizing the overall power supply for the control panel, it is necessary to know the amperage load of the panel. The only way to do this is to add the various output amperages of the devices as well as of each burner blower motor together. Obviously, this would require knowing all the devices that will be controlled or connected to the Vitocontrol C.

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Custom Control Corner

Once this current load is calculated, the electrician or whoever is responsible for the main electrical panels can install the appropriate breaker/ fuses for your Vitocontrol-C panel.

Pump Control

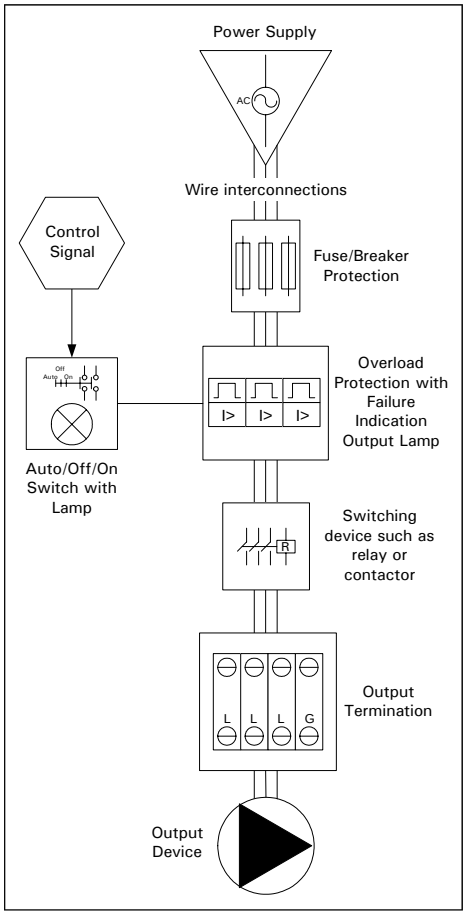
The control of various pumps within a system is another invaluable feature of the Vitocontrol-C. Whether the job is a new installation or a retrofit, the control panel is able to provide the control necessary to operate the system pumps.

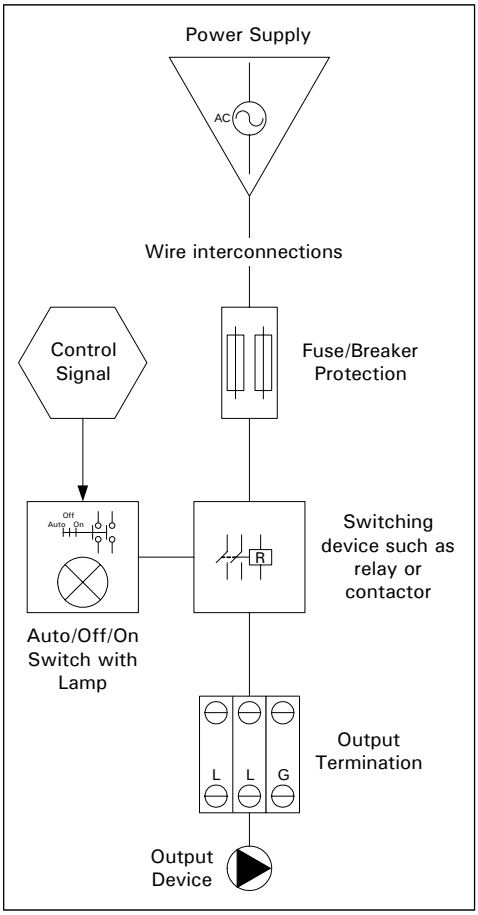
Quite often, in older systems, a visit is required to turn off the pumps for the summer season. This will also lead to a visit in the fall to turn on the pumps once again. However, a custom control panel can provide warm weather shut down which allows the service person to address more important matters.

Similar to the various power supply options, there are a number of aspects of pump control that are necessary to be determined prior to commencing with the control panel design. The biggest question of all is how the pumps are to be controlled. This aspect generally depends on the overall operation of the devices. When the pumps are used primarily for space heating, a signal is provided by the outdoor reset controller to turn the pumps on in the fall and off in the spring.

There may be parts of the system that do not require constant circulation. This is where demand control of pumps comes into play. Pumps that are controlled by devices such as set point controls or room thermostats, are outputs to be cycled on and off. The primary consideration of this kind of control is that for any controls external to the panel, a demand signal will be required to know when to start and stop the pump.

There are a number of various pump outputs that can be used. These will vary, depending on the complexity of the systems.





Some examples are:

- Boiler supply pump
- Boiler shunt pump
- DHW pump
- DHW recirculation pump
- Space heating pump with M/V control
- Space heating pump with TT control
- Pool pump
- Spa pump

Just to name a few...

A number of options can be used with the various selections of pumps, regardless if the pump is for a boiler or a towel rad. Some of them include rotation for multiple pumps, dual head control as well as VFD control. When addressing the option list, there may also be aspects of the system that have to be addressed as well. If you are installing back up pumps in case of a pump failure, it is imperative that the necessary isolation valves are installed to allow for servicing of the defective pump. If the intent is to have an automatic pump back-up, then you may need flow switches installed. If this is the case, then the output of the flow switch will need to be run back to the control panel.

Depending on how the options are configured, this will affect the overall operation of the panel as well as the total load calculation. In a case where standby or back-up pumps are capable of operating at the same time, the panel power supply has to be sized for the total current draw of all the pumps. If a mechanical/electrical interlock is used, then the panel can be sized for only the pumps that are capable of running.

When providing information for pump control, it is necessary to supply both the voltage and current requirements of the pump. It is very important that HP figures are not used to determine current demands. Information regarding current loads can vary greatly in respect to similar sized HP figures. One manufacturer may quote a 5HP pump at 2FLA whereas another may specify 7FLA.

Continued on following page

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Custom Control Corner

The differences in amperage ratings between the pumps may add up to hundreds of dollars worth of relays, contactors or overloads.

The photographs on this page show the sections contained within a typical control panel. The photographs also relate to the *module* drawings included in this edition of Vitotalk. Following the pictures, samples of a panel schematic have also been included. By including the module, picture and schematics, you will be able to see how they all interrelate with one another.

Upcoming editions of Vitotalk will expand further on the various aspects of Vitocontrol-C panels. This includes mixing valve controls, pool and spa controls, snow melting controls, DHW controls and some other unique applications.

The design of the control panel is only one piece of the puzzle when creating a Vitocontrol-C. Future issues of Vitotalk will review the various steps take before a C is created. What happens once the approval drawings are "Okayed"? We will go through the various steps taken to bring a panel to life. As well, you may be asking yourself, "What happens once it leaves your shop doors". Well, that is an excellent question too.

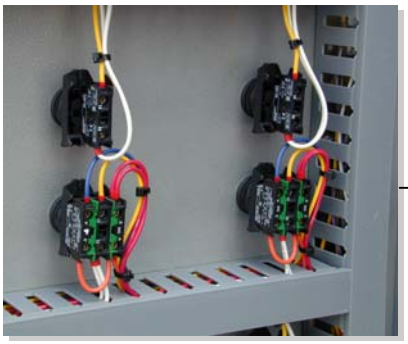
The installation of a custom control panel is a frequently asked question:

- How does it get mounted to the wall?
- Can it be suspended?
- Who wires it?
- What kind of wire is used?
- How heavy is it?
- What happens when replacement parts are needed?
- What is the panel rated for?
- How do you change a bulb?
- How do you change a switch?
- How is the panel diagnosed?

These are only a sampling of the questions that we receive.

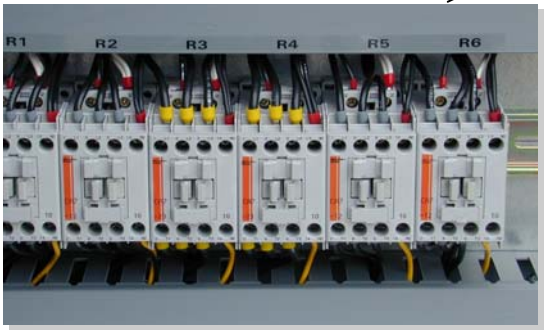
So, look to future issues of Vitotalk for all of these questions to be answered. In the meantime, should you have any questions, please contact us.

Picture 1: Distribution terminals



Picture 6: Switches

Picture 2: Main Fuses



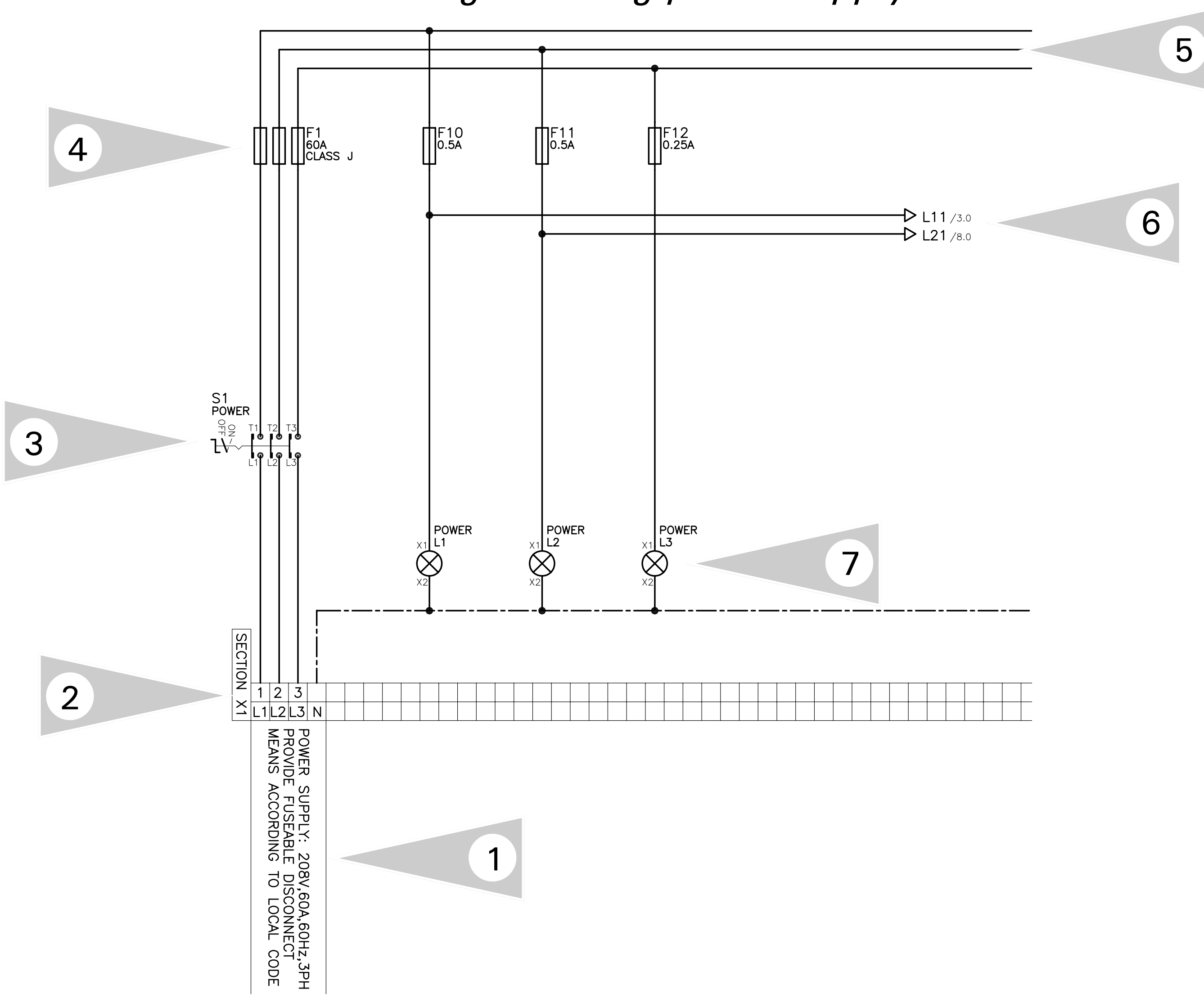
Picture 5: Contactors

Picture 4: Overloads

Picture 3: Fuses

Custom Control Corner

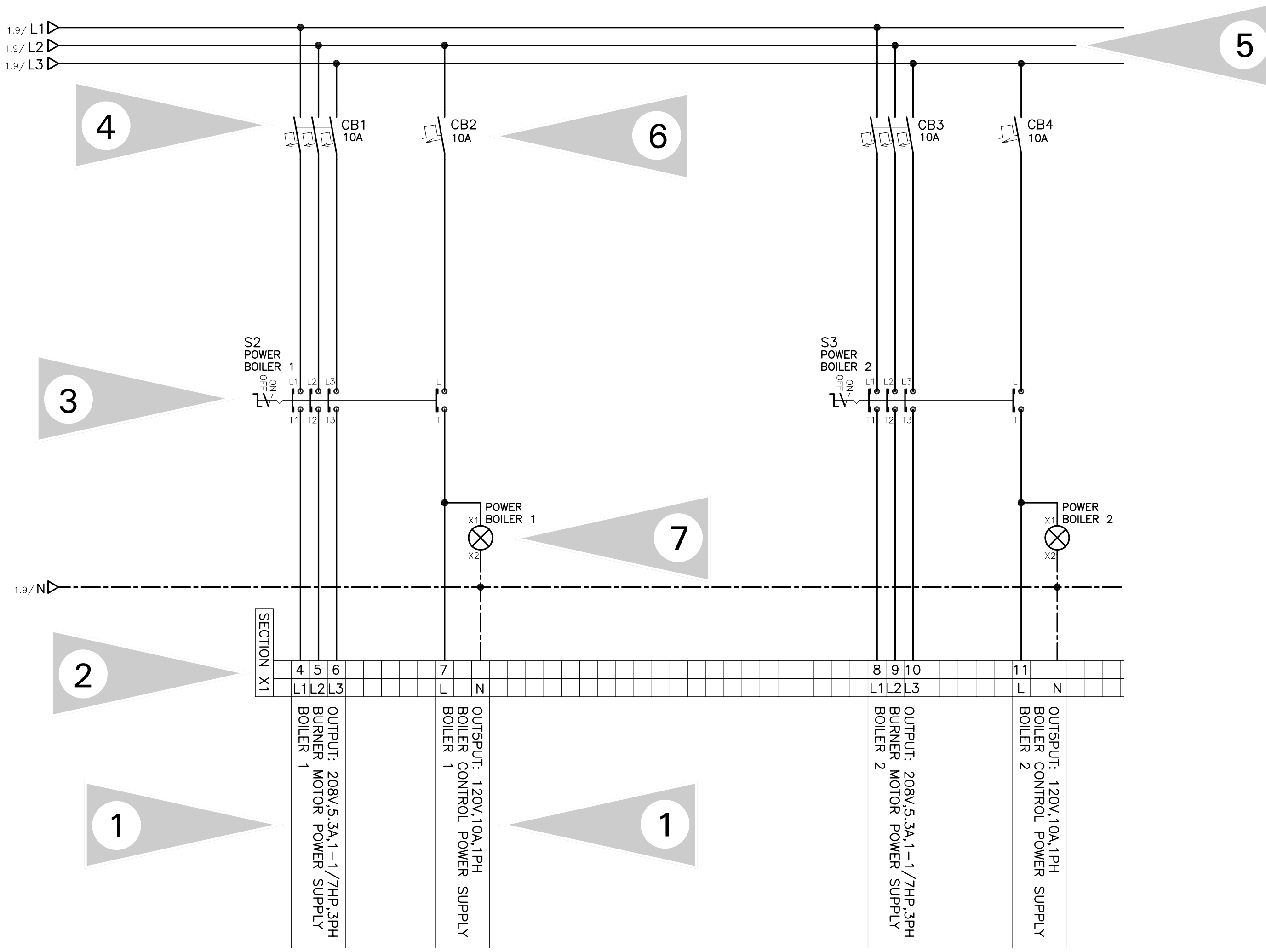
Excerpts from panel schematic showing incoming power supply



1	Incoming power supply sized for entire load of panel with all devices connected and functioning. Note 3 phase 208VAC. Electrician must provide fuseable disconnect.
2	Section of DIN rail inside of panel where all field connections are made. Depending on panel, there may be a number of sections providing various inputs/outputs/voltages.
3	Main panel On/Off disconnect. Usually mounted on side of panel. Note the switching of all three phases of the incoming 208VAC.
4	Main fuses provide protection for entire panel. Each circuit is also fused for short circuit protection.
5	On-going supply wiring to other areas within the control panel. Entire schematic has to be referenced when looking to see where power goes.
6	Voltage take-offs within panel provide voltage to panel devices & accessories. Note numbering scheme referencing pages and sections of associated schematic pages.
7	Status indicators for all three legs of incoming power supply. Note that each indicator is protected by its own fuse.

Custom Control Corner

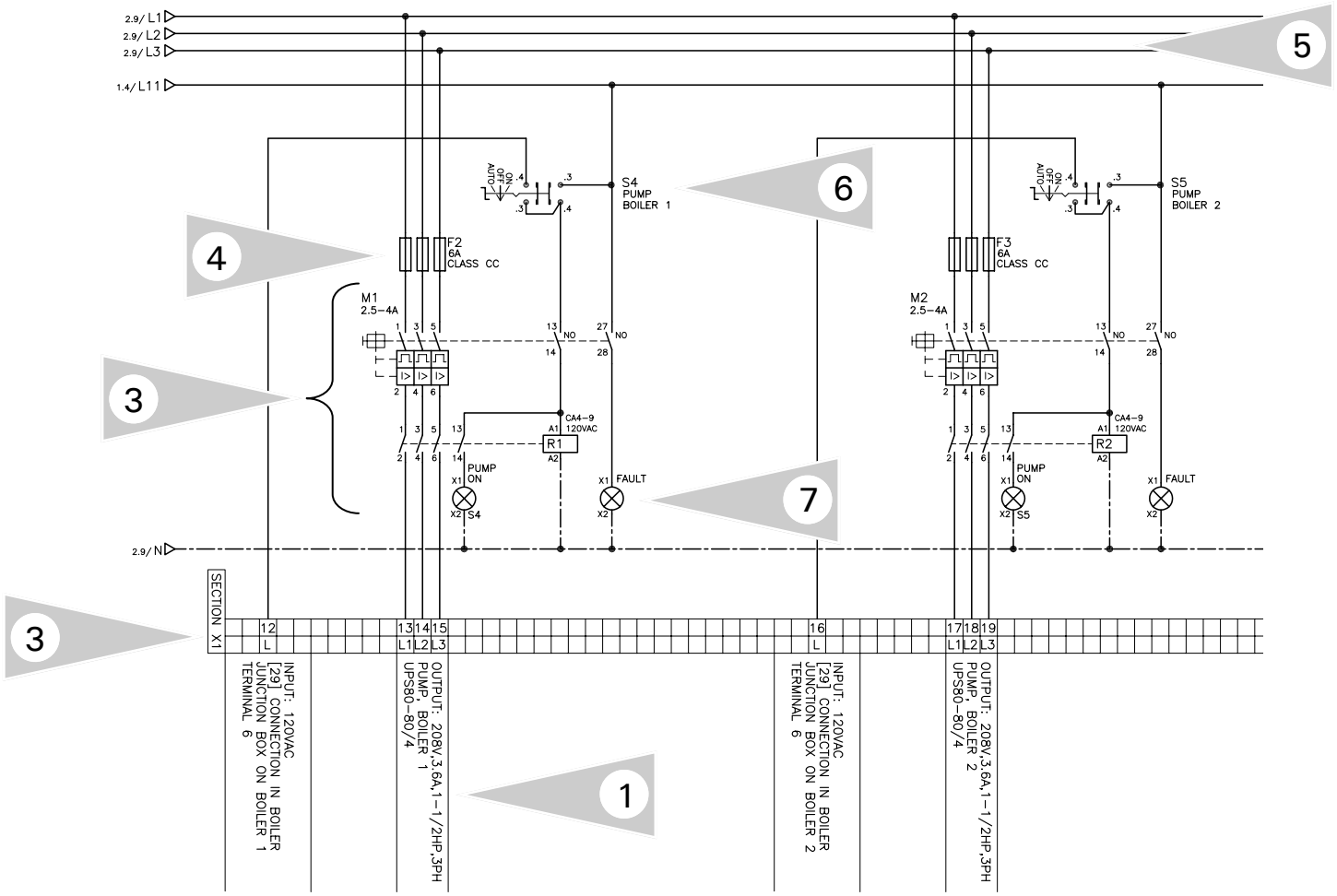
Excerpts from panel schematic showing power supply to burners



1	Power supply output to burner and control. Note that the burner has no Neutral wire but the 120VAC output has Line and Neutral connections.
2	Section of DIN rail inside of panel where all field connections are made. Depending on panel, there may be a number of sections providing various inputs/outputs/voltages.
3	Panel mounted disconnect switch to turn off 3 phase burner voltage as well as switching the 120VAC power source to the boiler control.
4	Circuit breaker to provide overload protection. Switches all three phases off when trips. Only removes 3 Phase.
5	On-going supply wiring to other areas within the control panel. Entire schematic has to be referenced when looking to see where power goes.
6	Circuit breaker for 120VAC control voltage.
7	Power ON status of boiler control power supply.

Custom Control Corner

Excerpts from panel schematic showing power supply for pumps



1	Output 208VAC for 3 phase pump control. All components suitable for the 3.6A draw that the pump is rated for.
2	Section of DIN rail inside of panel where all field connections are made. Depending on panel, there may be a number of sections providing various inputs/outputs/voltages.
3	Current overload, contactor, ON status switching and auxiliary switch blocks make up a complete 3 phase output.
4	Pump fuses provide protection for specific output.
5	On-going supply wiring to other areas within the control panel. Entire schematic has to be referenced when looking to see where power goes.
6	Control panel door switch operates Auto/Off/On function. Bypass the call from boiler control for operation of pump in ON mode.
7	Fault indicator mounted on panel door to indicate that the motor overload has tripped and needs to be reset, once the pump and/or wiring is checked for faults.

Answers from Communication/Demand test
Demand/Command
Demand/Command
Communication
Communication
Both